Growth of aligned carbon nanotubes for nanoelectronics

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ABSTRACT

The miniaturization of electronic devices into nanometer scale is indispensable for next-generation semiconductor technology. Carbon nanotubes (CNTs) have already been shown to be useful in a variety of functional devices such as nano-electromechanical system (NEMS), field-effect transistors (FETs), interconnects, atomic force microscope (AFM) probes, etc.

The Y-junction Singlewall CNTs have attracted much attention due to their potential to be used as future nano electronics, where the third terminal is used for controlling the switching, power gain, or other transisting purposes. Our recent work demonstrated the successful growth of Y-SWNTs by controlling catalyst type. The Y-SWNTs were catalytically synthesized by thermal CVD using a doped Fe particle as catalysts. Most of the synthesized SWNTs have branches, forming Y-junctions. Transmission electron microscopy (TEM) images confirmed that a Y-SWNT consists of three isolated SWNTs with different diameters. Raman spectra showed that our sample has both semiconducting and metallic SWNTs. The results of TEM and Raman measurements are indicative of the possible formation of Y-SWNTs with different electrical properties. Most recently, we have also found that the Y-SWNTs grown at different temperature have demonstrated different electrical characteristic.

The Surface modification of the carbon nanotubes plays an important role for their utilization in various applications. The surface of grown nanotubes was modified and the wettability on nanotubes was investigated. This functionalisation tends to change the surface of nanotubes into hydrophilic thus increasing its sensitivity. The electrical characterization of these modified nanotubes was performed since it is expected that by adapting analysts onto the modified nanotubes, the electric transport property of CNT may be changed.

In this presentation we will discuss the central issues to be addressed for realizing carbon nanotube (CNT) future electronic devices. We focus on the controlling CNT growth, electron energy bandgap engineering and device integration.

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